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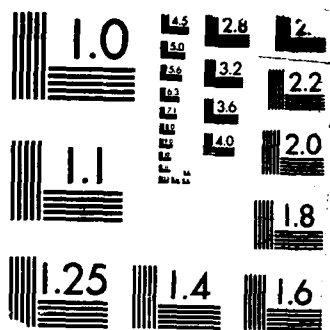
STRATEGIC DEFENSE INITIATIVE PROGRAM: NATIONAL TEST BED 1/1
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United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-223094

June 9, 1988

The Honorable Bill Chappell, Jr.
Chairman, Subcommittee on Defense
Committee on Appropriations
House of Representatives

Dear Mr. Chairman:

As you requested, we assessed the Strategic Defense Initiative Organization's (SDIO) National Test Bed (NTB) program to determine the progress being made in acquiring simulation and testing capabilities for the Strategic Defense Initiative. Although progress is being made, NTB acquisition has not proceeded as planned. It took program officials 9 months longer than planned to award a contract to implement the final NTB phase; program objectives to establish an early analysis capability (consisting of computer hardware, software, and analysts) were not fully achieved when intended; and construction of the National Test Facility (NTF)--the core of NTB where simulations and experiments are to be managed--has been delayed.

The National Test Bed (NTB) Program
The purpose of ~~NTB~~ is to provide a computer-based simulation capability to assess strategic defense systems without actually building or deploying such a system. ~~NTB's~~ total acquisition cost exceeds \$900 million as estimated through fiscal year 1993. SDIO initiated the NTB acquisition in February 1986, and the program is currently in the final phase--implementation, integration, and operation. Construction of the NTF portion of the NTB started in March 1988. Cont'd p. 4

NTB is an essential element within the Strategic Defense Initiative program because it can potentially provide the data considered necessary for a full-scale development program decision in the early 1990s (generally anticipated in 1992). These data are intended to increase confidence and support judgments about a strategic defense system's military effectiveness, survivability, and cost-effectiveness. Although it is too early to determine the effect of NTB program delays on the overall Strategic Defense Initiative program, the progress of NTB acquisition during the next few years will be critical in terms of support to decision-makers.

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Appendix I discusses these matters in greater detail.
Appendix II discusses our objective, scope, and methodology.

We did not obtain official agency comments; however, we did discuss the contents of this report with SDIO officials and their comments were incorporated where appropriate.

We are sending copies of this report to the Secretary of Defense; the Director, Office of Management and Budget; and other interested parties. If you need additional information or have any questions, please call me on 275-4841.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "Thomas G. Brew". The signature is stylized with a large, sweeping initial "T" and a cursive "B".

Thomas G. Brew
Associate Director

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ABBREVIATIONS

BM/C3	battle management/command, control, and communications
JPO	Joint Program Office
NTB	National Test Bed
NTF	National Test Facility
SDI	Strategic Defense Initiative
SDIO	Strategic Defense Initiative Organization



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NTB ACQUISITION HAS NOT
PROCEEDED AS PLANNED

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→ In March 1983, the President called for a comprehensive scientific research effort to develop a system that would render ballistic missiles impotent and obsolete. This effort, known as the Strategic Defense Initiative (SDI), is a multibillion dollar research program to determine the feasibility of developing and deploying a defense system against nuclear ballistic missiles.

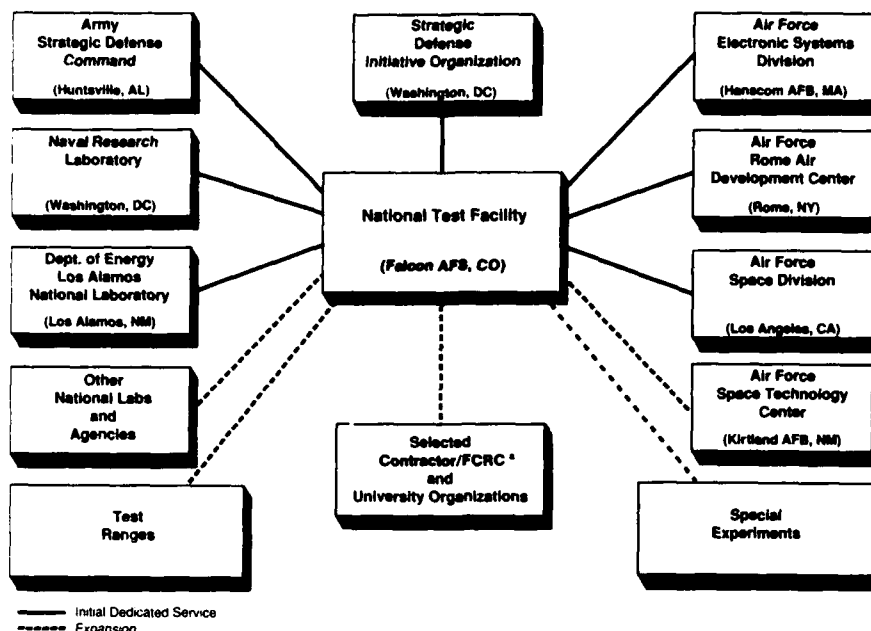
Strategic Defense Initiative Organization
SDIO was formed by the Secretary of Defense to manage the program and explore candidate technologies for a strategic defense system.

Six technologies are currently in the concept demonstration/validation phase of the acquisition process. These technologies--three sensor systems; two weapon systems; and a battle management/command, control, and communications (BM/C3) framework--were proposed by SDIO as comprising the first phase of a comprehensive strategic defense system.

Throughout the concept demonstration/validation phase, extensive testing and evaluation of the proposed strategic defense system will be required to support a decision in the early 1990s (generally anticipated in 1992), on whether to proceed into the full-scale development phase. The NTB program, initiated by SDIO in February 1986, is essential to testing and evaluating a strategic defense system, as well as its component technologies. Acquisition of NTB capabilities, however, has not proceeded as planned. ← For example, it took program officials 9 months longer than planned to award a contract to implement the final NTB phase; program objectives to establish an early analysis capability were not fully achieved when intended; and construction of the NTF building, a part of NTB, has been delayed.

Figure I.1 shows a diagram of the planned NTB that is to interconnect several Army, Navy, Air Force, Department of Energy, and other national test and demonstration facilities throughout the country into a single, distributed SDI resource. The core of NTB is NTF which is to be located at Falcon Air Force Station, Colorado. When completed, this government-owned, contractor-operated facility is to be the repository for SDIO's standard threat and environment models, and the location where simulations and experiments of an entire strategic defense system are to be managed.

Figure I.1: Diagram of the NTB Network



NTB IS IMPORTANT TO EVALUATING A STRATEGIC DEFENSE SYSTEM

The Fletcher Panel and the Eastport Study Group--both composed of members from industry, government, and academia--identified the need for computer simulation to test and evaluate strategic defense system concepts and designs. In 1983, the Fletcher Panel issued a report¹ stressing that BM/C3 architectures, systems architectures, and major subsystems must be proposed in realistic detail and tested through simulation to acquire performance data on such complex systems. The Panel proposed developing a capability that would provide a range of options from simulations of entire strategic defense systems to detailed analyses of individual weapon and sensor models. In 1985, the Eastport Study Group recommended that SDIO construct several different, but centrally coordinated simulators for testing and debugging the strategic defense system and evaluating BM/C3 strategies. The Group believed that the ability to have confidence in a total strategic defense system is critical, and to achieve it, the computer programs and algorithms of the BM/C3 and systems architectures must be tested in detail under a very large number of battle variations.

¹ Eliminating the Threat Posed by Nuclear Ballistic Missiles, James C. Fletcher, Study Chairman, October 1983.

SDIO agreed with both Panel and Group assessments of the importance and need for simulation, and initiated the NTB program to acquire the necessary capabilities. According to SDIO, NTB capabilities are essential in making an informed full-scale development decision on a strategic defense system because the Anti-Ballistic Missile Defense Treaty restricts testing of an actual system in space. SDIO considers NTB to be its primary tool for assessing and validating the feasibility of integrating BM/C3 capabilities with sensor and weapon systems and ultimately for testing system interoperability. NTB is intended to sufficiently represent a strategic defense system so that the system's military effectiveness, survivability, and cost-effectiveness can be evaluated without actually building or deploying such a system.

PROGRAM ORGANIZATION AND MANAGEMENT

SDIO initiated the NTB acquisition in February 1986. In August 1986, it created the NTB Joint Program Office (JPO) at the Air Force's Electronic Systems Division to assume program management responsibility. In the fall of 1986, JPO established an office at Falcon Air Force Station, Colorado to monitor construction of the NTF building and to establish an interim test facility in the existing Consolidated Space and Operations Center building at the Station.

SDIO developed a three-phased NTB acquisition strategy that included concepts and requirements definition (phase I); preliminary design (phase II); and implementation, integration, and operation (phase III). Phase I began in March 1986 when SDIO competitively awarded four \$1 million firm fixed-price contracts. In July 1986, SDIO selected two phase I contractors to continue into phase II. This phase was completed in December 1986 at a cost of \$2.7 million per contract. JPO then began preparing a request for proposals for phase III, with intentions of awarding a contract in April 1987. However, it was not until January 1988 that JPO awarded the contract to Martin Marietta Information and Communications Systems. Construction of the NTF building is a separate activity from the NTB effort, and in February 1988, JPO exercised a contract option with the Kaiser Construction Corporation. Actual construction started in March 1988.

The total estimated acquisition cost of the NTB (including design and construction of the NTF building) is over \$900 million through fiscal year 1993 as shown in table I.1.

Table I.1: Estimated Acquisition Cost of NTB

<u>Appropriation account</u>	<u>Prior years</u>	<u>Fiscal years</u>				<u>Total</u>
		<u>88</u>	<u>89</u>	<u>90</u>	<u>91-93</u>	
		----- (millions) -----				
Research, development, test, and evaluation	\$40.5	\$76.7	\$115.0	\$116.0	\$462.0	\$810.2
Military construction		35.0	72.5			<u>107.5</u>
Total estimated acquisition costs						<u>\$917.7</u>

IMPLEMENTATION CONTRACT AWARD DELAYED

JPO awarded the NTB implementation contract (phase III) in January 1988--9 months later than originally scheduled. The primary reason for the delay was that JPO needed additional time to prepare the requirements because of technical concerns raised by SDIO advisory groups. JPO officials also attributed part of the delay to an internal debate over the type of contract to use.

JPO solicited input on the NTB development approach from two advisory groups (consisting of members from industry, government, and academia) formed by SDIO. In November 1986, these groups--the Eastport Study Group and the NTB Ad Hoc Advisory Group--expressed the following concerns about NTB development:

- NTB contractors were concentrating on developing and designing computer hardware configurations without placing enough emphasis on developing associated software.
- Neither JPO nor the NTB contractors were developing standards and protocols to provide guidelines for developing simulation software modules that could be integrated.
- JPO was procuring NTB as a finished product, instead of developing and building it in incremental blocks.

The groups recommended that JPO address these concerns before proceeding into phase III--implementation.

The NTB Ad Hoc Advisory Group raised concerns again in February 1987 after reviewing a draft copy of the phase III technical requirements. Group members stated that the draft request for

proposal was still too detailed in terms of specifying the type of hardware to be provided and that it did not adequately address more significant issues such as software development and simulation. For example, the draft specified the number of communication networks, workstations, and printers which would be located at the NTF, but devoted little more than a page to simulation requirements. The members recommended reducing the level of detail for the hardware requirements to allow the contractors to suggest alternate solutions, and to more fully develop the software and simulation requirements. JPO revised the technical requirements by eliminating several hardware specifications and adding sections on system simulations. JPO also revised its acquisition strategy by placing emphasis on implementing NTB in increments during the first 2 years, with additional capabilities to evolve in later years. This was in contrast to the phase II proposals that emphasized a completed system at the end of 5 years.

According to JPO officials, an internal debate over the type of contract to use also contributed to the delay in issuing the request for proposals. The debate centered on the Air Force Electronic Systems Division's preference for a fixed-price contract versus SDIO's preference for a cost-type contract. Because of several unknowns associated with long-term development of simulations, a cost-plus-award-fee contract was ultimately selected.

EARLY ANALYSIS CAPABILITY NOT
FULLY ACHIEVED WHEN INTENDED

JPO recognized that there would be some delay in awarding the phase III implementation contract. Because of its desire to keep the program moving, JPO decided to provide in-house test and evaluation support to NTB users as an interim measure before selecting the phase III contractor. According to JPO officials, a decision was made in January 1987 to establish an early analysis capability (consisting of computer hardware, software, and analysts) by April 1987 at the interim NTF site in the Consolidated Space Operations Center building. By January 1988, when the phase III contract was awarded, JPO had only partially achieved the capability that was desired by April 1987--9 months earlier. As a result, analytical assistance to NTB users was not fully available when intended.

JPO had two specific early analysis capability objectives. The first was to provide supercomputing support to potential NTB users, such as systems architecture developers and other SDI program developers, so that they could run unique simulation programs. This was to be accomplished by leasing time on a supercomputer at the Department of Energy's Los Alamos National Laboratory in New

Mexico, and establishing a high-speed, secure communications network connecting this computer to several SDIO sites. The second objective was to develop simulation standards and protocols, and NTB operational concepts and procedures, and to gain in-house expertise in using simulations. This was to be accomplished by hiring 12 computer analysts.

Necessary computer access
not obtained when expected

By April 1987, the early analysis capability was to include three sites--Los Alamos, SDIO Headquarters, and the interim NTF--all interconnected by high-speed (56,000 bits per second) secure communications. By July 1987, the analysis capability was to be expanded to include the Air Force's Electronic Systems Division and Rome Air Development Center, the Naval Research Laboratory, and the Army Strategic Defense Command. However, as of early January 1988 just before selecting the phase III contractor, JPO had only established low-speed (2,400 bits per second) secure communications between the first three sites. This resulted in only limited access to the supercomputer. Only low-speed communications were achieved primarily because of difficulties in contracting for design and installation of hardware (computers, communication systems, cryptographic equipment, and workstations) and the resulting delays in requesting required communication security approvals from the National Security Agency.

In January 1987, JPO planned to design and install the early analysis hardware through existing Air Force contracts rather than awarding a new contract specifically for this purpose. This approach was intended to expedite achieving the early analysis capability. However, Air Force contracting specialists subsequently concluded that the work was outside the scope of the established Air Force contracts. It was not until January 1988--one year later--that the design and installation work actually began. JPO had not done sufficient work to design and install the interim test facility equipment so that timely approval could be provided by the National Security Agency. As of March 1988, JPO had achieved an early analysis capability equivalent to that which was originally intended in April 1987--11 months earlier--but had not yet achieved the capability that was intended by July 1987.

Hiring goals for in-house
analysts not met

JPO also planned to establish an in-house analytical capability by hiring a cadre of computer analysts. JPO wanted the analysts to (1) assist NTB users, such as SDIO's systems architecture group, to analyze alternative strategic defense system configurations, (2)

develop standards for integrating software into the NTB simulation framework, (3) develop operational procedures and guidelines for future NTB users, and (4) enable JPO to more effectively interact with the phase III contractor who would be charged with NTB implementation and operations.

JPO planned to hire 4 analysts by May 1987 and a total of 12 by August 1987. However, as of March 1988, only two analysts had been hired. JPO officials attributed this hiring delay to cumbersome personnel procedures. They stated that because all three military services--Air Force, Army, and Navy--contribute staff to JPO, the procedures for hiring personnel are complicated. The position descriptions, ranks, and composition of all staff (including the analysts) required the approval of each service, and hiring analysts required more time than anticipated. Although the position descriptions for the analysts were completed in January 1987, actual hiring approval was not obtained by each of the services until October 1987. By March 1988, actions were still underway to hire nine more analysts, but JPO officials were unsure when the process would be completed.

NTF CONSTRUCTION HAS BEEN DELAYED

Construction of the building to house the core of NTB--the NTF--at Falcon Air Force Station, Colorado has been delayed because of funding constraints and winter weather conditions. SDIO intended to start construction in November 1987 (assuming that fiscal year 1988 military construction funds were appropriated by October 1987) and complete the building by September 1989--a 22-month construction schedule. It actually started construction in March 1988 (4 months later than planned), and current plans are to complete the building in November 1989 (2 months later than planned) for an overall 20-month construction schedule. SDIO officials stated that the start of construction was delayed because it did not receive all of the \$100 million in military construction funds requested from the Congress in fiscal year 1988, and the funds it did receive were not available when anticipated. In addition, after receiving fiscal year 1988 appropriations, SDIO was unable to start construction immediately because of weather conditions at the construction site.

The conference report on the Military Construction Appropriations Act, 1988 (enacted on December 22, 1987) states that a phased funding approach would be provided by appropriating \$35 million. It suggested that the remaining funds be requested in fiscal year 1989. The Senate Committee report on 1988 military construction appropriations expressed concern that the goals of the NTF and the entire NTB program were vague and not fully defined. As a result, the appropriations conferees agreed with Senate bill language that

restricted the use of funds until certain development conditions were met. The act required that none of the funds were to be obligated or expended until SDIO had begun certain architecture work, and provided reports to the House and Senate Committees on Appropriations on (1) this architecture work and (2) the capability of the NTF and other NTB components.

SDIO may be somewhat optimistic regarding the current building construction schedule. The SDIO Director reported to the House and Senate Committees on Appropriations in January 1988 that "worst-case planning" could result in a 5-month delay from the original schedule. This would result in completing the building in February 1990. SDIO has emphasized that to avoid a break in construction and to maintain the current construction schedule, it must receive fiscal year 1989 military construction funds in October 1988.

Meanwhile, JPO plans to continue using space in the Consolidated Space Operations Center as an interim test facility. However, the Center was built to house operations and control functions for several Air Force satellite programs. Because of these prior commitments, JPO is required to vacate part of its space by January 1989 and the remainder in January 1990. JPO also anticipates that growth in NTB activity will require additional space by August 1988. It therefore plans to acquire temporary modular buildings to accommodate this need at Falcon Air Force Station. These buildings are to be used for administrative purposes only.

SUMMARY

NTB is an essential element of the SDI program because it is expected to provide the data considered necessary to make a full-scale development program decision in the early 1990s. During the existing concept demonstration/validation phase, these data are intended to increase confidence and support judgments about a strategic defense system's military effectiveness, survivability, and cost-effectiveness. However, acquisition of NTB test and evaluation capabilities has not proceeded as planned. It took program officials 9 months longer than planned to award a contract to implement the final NTB phase; program objectives to establish an early analysis capability were not fully achieved when intended; and NTF construction has been delayed. It is too early to determine the effect of these delays on the overall SDI program.

OBJECTIVE, SCOPE, AND METHODOLOGY

As requested by the Chairman, Subcommittee on Defense, House Committee on Appropriations, we assessed SDIO's NTB program to determine progress made in acquiring the desired simulation and testing capabilities for SDI.

We interviewed officials at SDIO Headquarters, Washington, D.C.; the NTB Joint Program Office at Hanscom Air Force Base, Massachusetts; and the interim NTF at Falcon Air Force Station, Colorado. We reviewed planning and contractual documents, cost and schedule information, system requirements and design data, and correspondence concerning the management and direction of the NTB program. Our review was performed from January 1987 to March 1988 in accordance with generally accepted government auditing standards.

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